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ABSTRACT

This document consists of four agriculture extension service publications from Pennsylvania State University. The titles are: (1) Important Insect Pests of Fruit; (2) Important Insect Pests of Nuts; (3) Field Crop Insect Pests; and (4) Insect Pests of Vegetable Crops. The first publication gives the hosts, injury, and description of 22 insect pests of fruit crops. The second publication discusses the habits and damage of various insect pests of chestnuts, hickory and pecan nuts, filberts and walnuts. A section on pesticides for control of some of these insects is also presented. The third publication describes the damage and habits of common pests of alfalfa, corn, oats, soybeans, and wheat in Pennsylvania. The final publication in this collection discusses the habits and damage of common vegetable crops including carrots, peas, potatoes, sweet corn, and tomatoes. (MR)

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College of Agriculture, The Pennsylvania State University, University Park, Pennsylvania

IMPORTANT INSECT PESTS OF FRUIT
(LISTED BY HOST PLANT)

APPLES
Apple maggot
Codling moth
European red mite
Grape leafhopper
Plant bugs
Plum curculio
Red-banded leafroller
San Jose scale
Tufted apple bud moth
White apple leafhopper

APRICOTS
Oriental fruit moth
Peach tree borer
Plum curculio
San Jose scale

BLUEBERRIES
Apple maggot

CHERRIES
Apple maggot
Cherry fruit fly
Lesser peach tree borer
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Plum curculio
San Jose scale

CRABAPPLES
Apple maggot
Plum curculio

CURRANTS
San Jose scale

GRAPES
European red mite
Grape berry moth
Grape flea beetle
Grape leafhopper
Japanese beetle
Red-banded leafroller

GOOSEBERRIES
San Jose scale

HAWTHORN
Plum curculio

NECTARINES
Lecanium scale
Oriental fruit moth
Peach tree borer
Plum curculio
San Jose scale

PEACHES
Lecanium scale
Lesser peach tree borer
Oriental fruit moth
Peach tree borer
Plant bugs
Plum curculio
San Jose scale

PEARS
Codling moth
European red mite
Oriental fruit moth
Pear midge
Pear psylla
Plum curculio
San Jose scale

PLUMS
Apple maggot
European red mite
Lesser peach tree borer
Oriental fruit moth
Peach tree borer
Plum curculio
San Jose scale

QUINCE
Codling moth
Oriental fruit moth
Plum curculio
San Jose scale

VIRGINIA CREEPER
Grape leafhopper

IMPORTANT INSECT PESTS OF FRUIT

APPLE MAGGOT

Hosts: Wild crabapples, blueberries, cherries, plums, and apples.

Injury: The maggot feeds on the apple, forming brown, winding trails in the flesh on the fruit.

Description of Pest: The adult fly is black, slightly smaller than a house fly, and has three or four white bands on the body. The wings are marked with four black bands. The adult feeds on drops of water on fruit and foliage. Two weeks after the adult female emerges, she lays eggs. Because of this long interval between emergence and egg-laying, maggots are rarely a problem in a well-sprayed orchard.

The adult fly makes a small slit in the skin of the fruit to lay her eggs. Eggs hatch in a few days, and the maggots feed in the fruit until they are full grown; then they drop to the ground.

There is one generation each year. Adults start to emerge in early July and may be found in July, August, and September. During this period, eggs are laid in host plants. The maggots tunnel through the apple for two to four weeks before dropping to the soil to pupate. They overwinter as pupae.

CHERRY FRUIT FLY

Host: Cherry.

Injury: Maggots feed in the fruit, causing contamination.

Description of Pest: The adult fly is black, smaller than the house fly, and has four black bands on the wings. They mate shortly after emerging, but eggs are not laid for about a week. The maggots are about 1/4 inch long, white, without legs or visible head, and their bodies taper to the front end.

There is only one generation per year. They overwinter as pupae in the soil. Adults emerge in late June and July. Eggs are laid in the fruit and hatch in about four to six days. The maggot feeds for fourteen to eighteen days before leaving the fruit to pupate in the soil.

CODLING MOTH

Hosts: Apple, pear, and quince; occasionally other fruits.

Injury: Infested apples have holes which have been eaten into the side or blossom end to the core. Masses of frass (insect-produced debris) often protrude from these holes.

Description of Pest: They overwinter as pinkish-white larvae with brown heads. They are about 3/4 inch long when fully grown. Pupation is in late April to early May, and adults emerge during May and early June; second-generation adults appear in late July and early August. The moths are grayish with brown patches on the tip of the front wings and have a wingspread of 1/2 to 3/4 inch.

EUROPEAN RED MITE

Hosts: Apple, plum, pear, and other deciduous fruit.

Injury: Mite feeding causes the leaves to turn brown, and this interferes with normal photosynthesis. Fruit buds are weakened and become more susceptible to winter injury. Fruit yield and quality are lower. Eggs laid in the blossom end of an apple are objectionable to consumers.

Description of Pest: The bright red eggs overwinter on twigs and smaller branches and begin hatching in May. Five to eight overlapping generations occur until fall. The young mites suck the sap from leaves for two to three weeks before reaching the adult stage. Each female lays about 30 eggs. The adult mite is bright red.

Biological Control: Orchardists using an integrated apple pest management program can encourage the small black lady bird beetle, Stethorus punctum, to reproduce in the orchard and suppress the population of the European red mite to below the economic injury level.

EUROPEAN RED MITE (on grapes)

The mite feeds on grape foliage causing early fall bronzing of leaves. When infestations are heavy, they can affect sugar content of fruit and reduce the grape crop and vine vigor. Winter is passed in the egg stage on the trunk and crevices of fruiting canes. Feeding begins near the veins at the base of leaves and gradually spreads to developing foliage. Several generations are present per season.

GRAPE BERRY MOTH

Host: Wild and cultivated varieties of grape berries.

Injury: First generation larvae spin silk webs for protection and feed in several green berries in the cluster before becoming full grown in June. The injured green berries turn partially or completely red prematurely. Larvae of the second generation usually injure two or three touching berries in their webbed nest. Injured berries shrivel and often fall prematurely. Full-grown larvae pupate in folded cutout portions of the leaves on the vine or ground. Only larval stages cause injury. Up to 50 percent or more of the crop may be lost when infestations are heavy.

Description of Pest: Adult moths are 5/16 to 3/8 inch in length, have a 1/2-inch wingspan, and are purplish-brown with smoky brown hind wings.

The grape berry moth has two generations per year. The insect overwinters in the pupal stage in the soil. Adults emerge in early June and again in early August. In the first generation, eggs are laid singly on grape berries and cluster stems, and in the second generation, eggs are laid on berries only. Larvae require about four weeks to become full grown, at which time they are about 1/3 to 1/2 inch long, and greenish-gray with brown heads.

GRAPE FLEA BEETLE

Host: Cultivated and wild grape buds and foliage.

Injury: Adults feed on swelling buds and prevent development of primary canes. Larvae skeletonize the upper surface of grape leaves.

Description of Pest: Adult beetles are dark bluish-black, very shiny, and about 3/16 inch long. They overwinter in trash and wooded areas and cause most damage to border rows near such areas. Adults start feeding just as grape buds start to swell. Larvae are dark brownish-black with black spots and are sparsely covered with hair. They feed in groups on the upper surface of grape leaves and on the blossom bud cluster.

Overwintering adults emerge in early spring, feed on developing buds, and lay masses of eggs on canes and sometimes on leaf surfaces. Hatching larvae migrate to developing grape foliage and feed for about five weeks before becoming full grown. They then drop or crawl to the ground and pupate in the soil. New summer adults emerge during late July and August and may develop a partial second generation which causes negligible damage.

GRAPE LEAFHOPPERS: THREE-BANDED LEAFHOPPER AND POTATO LEAFHOPPER

Hosts: Wild and cultivated grapes, Virginia creeper, apples, and other plants.

Injury: Adults and nymphs suck plant juices from grape foliage, causing the leaves to turn brown prematurely. Foliage injury reduces plant growth and reduces yield.

Description of Pest: The grape leafhopper adult is pale yellow with red markings on the wings. It is about 1/8 inch long and wedge shaped. Leafhoppers fly readily when the foliage is disturbed. Nymphs are greenish-white; they scurry to hide when they are disturbed. They feed mainly on the underside of the leaves.

The leafhoppers overwinter as adults in fallen grape leaves and in grasses under vines. Adults leave wintering quarters when early grape leaves are partially developed and begin egg laying in leaf veins after a few weeks' feeding. Nymphs feed for three to five weeks before becoming full grown. The second generation develops during August and September.

JAPANESE BEETLE

Hosts: Wild and cultivated grape foliage exposed to direct sunlight.

Injury: Adults consume the upper surface and green chlorophyl, leaving only a network of lower surface and larger leaf veins which turn brown within a few days. Economic damage usually occurs only to small plantings, especially young vines near lawn areas.

Description of Pest: Adults are about 1/2 inch long, metallic-green, and have coppery-brown wing covers. The beetles prefer sunny areas of the vine when feeding.

Adults begin emerging in July and reach a peak in about three weeks. A few beetles may be present in early September. Females live 35 to 40 days, and lay one or two eggs per day. Eggs are laid in the soil, usually in lawns, golf courses, and mowed grass areas. Young grubs feed on grass roots until the temperature starts to drop in the fall. Overwintering partially grown grubs burrow down below the freeze line in fall and return to grass root areas to complete development in the spring. Pupation occurs in the soil during June.

LECANIUM SCALE

Hosts: All fruit trees, especially peach and nectarine.

Injury: Heavy infestations will kill the smaller branches and will weaken the tree, making it more susceptible to other insects and disease. Large amounts of honeydew are secreted by the scale, making the fruit blackened and scarred.

Description of Pest: Mature females are grayish to dark brown, circular, convex, about 1/5 inch in diameter, and often covered with whitish powder. Eggs are laid in early summer. The young crawlers move to the underside of leaves where they remain until late summer, and then they migrate to the bark and small branches where they spend the winter.

There are two generations in southern Pennsylvania and only one generation in the central and northern part of the state. They overwinter as immature scales. Adults appear during late June and July.

LESSER PEACH TREE BORER

Hosts: Peach, plum, cherry, and a few wild plants.

Injury: Masses of gum exude from the branches where the borers are working. Borers weaken the tree and provide wounds where disease organisms may enter.

Description of Pest: The overwintering larvae vary from 1/4 to one inch in length. They begin feeding in early spring. Older larvae mature in May and June, and the younger larvae mature in mid-summer. Moths emerge during June, July, and August. The clear-winged moths are metallic bluish-black with pale yellow markings on the abdomen. The female lays her eggs in wounds and around cracks and crevices in the bark. The insect is most often associated with pruning wounds.

There is only one generation per year. Partly grown larvae overwinter in the inner bark. Larvae mature during June and July and pupate in the host. Adults emerge during the summer to lay eggs. Eggs hatch in one to two weeks, and the larvae again enter the tree.

ORIENTAL FRUIT MOTH

Hosts: Peach, nectarine, quince, pear, apricot, plum, and several other fruits.

Injury: The earliest indication of injury consists of a dying-back of the new growth of twigs in the spring. The larvae enter the fruit and make many feeding burrows.

Description of Pest: The adult has a wingspread of 1/4 inch. The moths are gray with brown markings on the wing; the larvae are grayish-white with a black head and are 1/2 inch long when full grown. They attack the fruit in much the same manner as the codling moth attacks the apple.

Several generations of the fruit moth are produced each year, but the first generation is the most numerous. They overwinter as larvae, pupate in April, and begin to emerge as adults during late April. Most eggs are laid during May. The succeeding overlapping generations extend into September.

PEACH TREE BORER

Hosts: Mostly peach and nectarine, but also apricot, cherry, and plum.

Injury: One of the first indications of borer attack is a mass of gum which exudes from around the base of the trunk. This gum may be from below the soil surface to several inches above the soil line and contain bits of wood chips, sawdust, and frass produced by the feeding worms. The burrowing injury will weaken the tree and make it more susceptible to disease organisms.

Description of Pest: The borer is a whitish, brown-headed worm about an inch long when full grown. The borer becomes active in April. The larger worms complete their development in June, and adults emerge during late July. The younger borers complete their development in July and August and emerge as adults during August and September.

The adult moths are active during the day and closely resemble wasps when they are flying. The female moth is dark blue with an orange band on the abdomen. The male moth has several yellowish bands across its abdomen. The female moth may lay as many as 500 eggs. The females lay eggs through the summer on the trunks of the trees in cracks and under bark scales, or in the soil near the trunk. The female moth is attracted to trees which have been mechanically injured or previously infested with borers.

Eggs hatch within two weeks and the young borers work their way into the stem.

PEAR MIDGE

Hosts: All varieties of pears.

Injury: The larvae work their way to the core where they destroy the seeds and hollow out a large cavity (frequently almost the entire interior of the young fruit).

Description of Pest: The mosquito-like adult is 1/10 inch long. The midges appear about the time the blossoms begin to show color. Eggs are laid in the unopened blossom and hatch in a few days. The larvae then eat their way into the fruit, where they mature in June and drop to the soil to pupate.

PEAR PSYLLA

Host: Pear.

Injury: The pear psylla secretes large amounts of honeydew which runs down over the foliage and fruit, and in which a sooty fungus grows. This causes the skin of the fruit to become blackened and scarred, and the foliage develops brown spots. Heavy infestations may cause partial to complete defoliation of the trees, reducing vitality and preventing the formation of fruit buds.

Description of Pest: Pear psylla adults look like small cicadas. They are about 1/10 inch long and are dark reddish-brown. The adults become active anytime the temperature is above 40° F. In the spring, eggs are laid in bud scales and in small crevices near the bud. During the summer, eggs are laid on the foliage and bark. Eggs hatch in two to three weeks, and the young nymphs migrate to the axils of leaves. Nymphs are yellowish, flattened, and covered with honeydew. They have sucking mouthparts and feed on plant sap.

PLANT BUGS

Hosts: Mostly peach and apple.

Injury: The injury referred to as "catfacing" is caused by plant bugs. Feeding causes funnel-shaped pits and distorted apples; on peaches, the injury is scarred and distorted areas which lack fuzz.

Description of Pest: The overwintering adults become active in late April and May when peaches are in bloom. The sucking insects feed on young peaches early in the season and often cause injury later in the spring. Injury is more severe in orchards where legume cover crops are grown.

Several generations are present each year. They overwinter as adults. Eggs are first laid in early spring, and continuous overlapping generations occur during the summer and fall.

PLUM CURCULIO

Hosts: Plums, peaches, apples, cherries, nectarines, apricots, pears, quince, crabapples, and hawthorn fruits.

Injury: The injury caused by the plum curculio to the fruit may be classified as follows: (1) feeding and egg laying of the adult in the spring, (2) feeding of the worm (larvae) in the fruit, and (3) feeding punctures in the fruit by emerging adults in the fall.

Description of Pest: The adult is a brownish-gray, hard-shelled snout beetle about 1/5 inch long, with four pairs of bumps on the upper surface of the body. When the adults emerge in the spring, they feed on the foliage and blossoms. After the shucks start to push off, the curculio infests the fruit. The beetle eats a small hole through the skin and then feeds on the pulp through this opening. Egg-laying scars in the skin of small fruits are crescent-shaped cuts with a small round hole. Eggs hatch in about a week and the young worm eats into the flesh of the fruit. When the worms become full grown, they drop to the ground and pupate. In about a month, they develop into adults.

RED-BANDED LEAFROLLER

Host: Apple, many deciduous trees.

Injury: The larvae skeletonize the leaves from the underside, folding and webbing them together. They feed on the fruit, especially when leaves touch the fruit, eating shallow, irregular channels.

Description of Pest: The adult has a wingspread of 1/2 inch. The forewing is marked with a band that widens towards the edge. Moths emerge in the spring and deposit egg masses on the underside of larger limbs. Eggs hatch in late fall into pale-green larvae with yellowish heads.

Three generations are produced each year. Winter is spent in the pupal stage. Adults emerge during April and May, and again in July and late August. Larvae may be found from May to late September.

RED-BANDED LEAFROLLER (on grapes)

Host: Cultivated and wild grapes, especially in the Erie County grape belt; also foliage of other fruits.

Injury: The first generation larvae injure grapes by feeding within the cluster on stems and berry surfaces. The second and third generation larvae bore into the berries. Only larvae cause damage, and such damage is confined to the cluster and fruit.

Description of Pest: Larvae are pale green, and about 5/8 inch long when full grown. The second generation is most destructive in Erie County.

The leafroller overwinters as a pupa, and the moth emerges in April to early May. The second generation of moths appears from mid-July to early August in Erie County, and more southern areas of the state have a partial to complete third generation.

SAN JOSE SCALE

Hosts: Apple, pear, quince, peach, plum, apricot, nectarine, sweet cherry, currant, and gooseberry.

Injury: The scale infests the bark, foliage, and fruit. It feeds on the fruit and foliage and causes small reddish spots on the fruits. Trees may be partially or entirely killed; fruit becomes unmarketable if the pest is not controlled.

Description of Pest: The scales are about 1/12 inch in diameter with yellow bodies protected by circular, grayish, scale-like coverings; they have sucking mouthparts. Each mature female produces several hundred small yellow crawlers (they are born alive) which migrate to new locations. These crawlers may be scattered by wind and birds.

Several overlapping generations are present each year. Each generation is completed in six to eight weeks. Overwintering is as nymphs which mature into adults at about the time the host reaches bloom.

TUFTED APPLE BUD MOTH

Hosts: Apple is favored.

Injury: Surface galleries and cavities occur where leaves are webbed to apples or where apples are touching. The characteristic feeding site on foliage is a leaf roll or leaf fold.

Description of Pest: The overwintering larvae remain on the ground cover if favorable weed hosts exist. The older overwintering larvae pupate during late April and May, and adult populations peak during early June. The younger larvae pupate during July, and adults are active during August and September. The larvae are most injurious in the fall when they feed on the fruit.

WHITE APPLE LEAFHOPPER

Host: Apple.

Injury: Leafhopper feeding causes a whitish speckling of the leaf surface; this reduces photosynthesis. Secreted honeydew and deposits of excrement cause russeting of the fruit.

Description of Pest: Adults and nymphs feed by sucking the sap from the leaves. Adults are wedge-shaped and about 1/10 inch long. The nymphs are pale, greenish-white, wingless, and very active. They can move forward, backward, or sidewise. Many white skins of the leafhoppers may be found on the leaves.

Leafhoppers overwinter as eggs in the bark, and they hatch during late May. Nymphs mature in about three or four weeks. The second generation appears during August and September.

Prepared by Stanley G. Gesell, Professor, Entomology Extension.

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IMPORTANT INSECT PESTS OF NUTS

Edible nuts, like all other crops, are subject to damage by specific insect pests. The purpose of this publication is to assist you in recognizing the insect pests and the damage caused by them. No insecticides are registered for use against some of the common pests, so other control measures must be attempted. Registered insecticides are listed separately.

PESTS OF CHESTNUTS

CHESTNUT WEEVIL

Two species of weevils attack the kernels of chestnuts. The adults of the two species are similar in appearance except for size. They are a mottled brownish color with a long, curved, nettle-like beak that is longer than the rest of the body. The large chestnut weevil is up to 3/4 inch long, and the small chestnut weevil is about half that length.

The adult weevils do little damage. The females use their long beaks to drill holes through the burs and deep into the developing nuts. They then deposit an egg into the freshly cut hole. The larvae (also called grubs) are legless, plump, off-white, and always lie in a curved position. Full-grown grubs are less than 1/2 inch long. The grubs feed on the meat of the nuts, ruining them for human consumption.

When the grubs reach maturity in October or November, they leave the nut through a small, round exit hole and enter the ground to pupate.

One method that may help reduce damage from these pests is to pick up all dropped nuts and place them in containers from which emerging grubs cannot escape. Unfortunately, the effectiveness of this control measure depends on the location of the chestnut trees in relation to oak and other nut trees on which these insects can also develop.

JAPANESE BEETLE

During July and August, considerable defoliation can result from the feeding of the coppery-green Japanese beetles. No insecticide is presently registered to control Japanese beetles on chestnuts. Little can be done other than picking the beetles off the foliage by hand. The best time of day to attempt this is in early morning before the beetles take to flight. The practicality of using this method on large trees is questionable.

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MITES

In some seasons, mite populations will develop to high enough levels to cause bronzing of the foliage which in turn causes a reduction in yield and size of nuts.

PESTS OF HICKORY AND PECAN

PECAN NUT CASEBEARER

The small (1/4 inch) larvae overwinter in small, closely woven, silken bags stuck to the twigs at the junction of buds. The larvae become active in the spring when the buds start to open. They feed on the developing buds and then bore into the new, tender shoots. The olive-green caterpillars with light-brown heads are about 1/2 inch long when mature. They usually pupate in the infested shoots and emerge as dark-gray moths when the nuts start to form. Eggs are deposited on the blossom end of the nuts, and the new larvae feed on the developing nuts. A second generation in late summer feeds on the shucks and foliage of pecans and hickory.

PECAN WEEVIL

These weevils are similar in appearance and size to the large chestnut weevil. The adult weevils feed on husks of developing pecans, causing the injured nuts to drop prematurely. The adults rarely feed on hickory. In late August and September, the adults deposit eggs in the nearly mature nuts. The grubs feed on the kernels and destroy the nuts. In the fall soon after the nuts drop to the ground, the grubs escape the nut through a small round exit hole and enter the soil to pupate and pass the winter.

GALL INSECTS

Several species of aphid-like insects called phylloxeras are common pests of pecan and hickory. The feeding of these small sucking insects is responsible for the formulation of galls on the leaves and twigs.

The majority of the galls are about the size of peas or beans and vary greatly in color, with green, red, yellow, and brown being most common. Galls that form on the twigs and stems can cause distorted growth. Serious growth distortion is seldom encountered in Pennsylvania.

No satisfactory control measures have been established for these pests.

PESTS OF FILBERTS

FILBERTWORM

White caterpillars with brownish heads pass the winter as fully grown larvae about 1/2 inch long. The moths emerge from spring to late summer. There is probably only one generation per year in Pennsylvania. The moths are extremely variable in color but are mostly reddish-brown. A broad copper-colored band is visible across the middle of the front wings.

This pest has a wide range of hosts including most of the cultivated and native nut species. The larvae tunnel between the husk and shell until they reach the basal scar; then they bore into the nut and feed on the kernel.

The filbertworm feeds on practically all types of nut species; therefore, isolating filbert bushes will have little effect in curbing the worm population. The destruction of dropped nuts is also of little value since new infestation can quickly arise from other nearby sources.

PESTS OF WALNUTS

HUSK FLY

This is by far the most important and destructive insect pest of black and English walnuts in Pennsylvania. The insect passes the winter as a pupa in the soil under walnut trees. The adult flies start emerging in July. They are nearly as large as the common house fly but are yellowish-brown and their wings are marked with brown bands.

Eggs are deposited in the husks of the walnuts, where the maggots feed. The feeding process produces a substance that penetrates the shell of the nut and stains the kernel. Off-colored kernels are not only unattractive but are also off-flavor.

The adult flies cannot successfully deposit their eggs until the nuts are approaching maturity and the husks become soft enough for the flies to insert their ovipositor. This usually occurs from mid-August until late September. A fact in favor of the grower is that maggots developing from eggs deposited after mid-September do not mature sufficiently to survive the winter. This indicates that the critical period for spray protection is between mid-August and mid-September.

WALNUT CATERPILLAR

The most obvious insect pest on walnut is the walnut caterpillar; they feed in clusters and cause noticeable defoliation. However, it is not of great importance because it usually does not occur until late summer when defoliation is limited to a few limbs; actual damage is relatively light.

The small caterpillars are reddish-brown and raise their heads and tails when disturbed. They seldom appear on trees before late July or early August. Fully grown caterpillars are almost black, hairy, and about two inches long.

The insect overwinters in the soil in the pupal stage. Moths emerge in late June and July. There is one generation per year. It is not uncommon to see large masses of caterpillars on the trunk of a walnut tree during the insect's molting periods. After shedding their skins, the caterpillars move onto a limb and resume feeding. Spot treatment of infested limbs is sufficient to check the feeding of this insect.

CURCULIOS

Two species of curculios attack walnuts. The adult weevils are similar in appearance, about 1/2 inch long with a snout about half the length of the body. They are brownish-gray with humps and ridges. They overwinter as adults in the ground cover. The grubs are fleshy and white with brown heads. Both the adults and the grubs damage the twigs, buds, and nuts. The greatest damage is probably to new shoots and twigs.

A reasonable control measure is collecting and destroying all nuts that drop prematurely.

PESTICIDES FOR USE ON EDIBLE NUTS

For many nut species, no pesticides are registered. Materials that are registered for use on chestnut and walnut will not completely control the major insect pests such as weevils, Japanese beetles, and husk flies. It is therefore impossible to develop an effective insect control program for our state's most important nut crops.

We have attempted to list the various insecticides which are registered for nut pests and which are reasonably safe to use.

Pest	Material	Dosage (per 100 gallons)
	ALMOND	
Aphids	Malathion 57% EL	1 to 2 pt
	Malathion 25% WP	2 to 2 1/2 lb
Note:	Use when needed.	
Twig Borer	Carbaryl 80% S	1 1/4 lb
	Diazinon 50 WP	1 to 1 1/2 lb
	Diazinon AG 500	1 to 1 1/2 lb
	Malathion 57% EL	1 to 1 1/2 lb
	Malathion 25% WP	3 to 4 lb
Mites	Diazinon 50 WP	1 to 1 1/2 lb
	Diazinon AG 500	1 to 1 1/2 lb
	Malathion 57% EL	1 to 2 pt
	Malathion 25% WP	2 to 2 1/2 lb
San Jose Scale	Carbaryl 80% S	1 to 1/4 lb
	Diazinon 50% WP	1 to 1/2 lb
	Diazinon AG 500	1 to 1/2 lb
Note:	Mix with dormant oil spray.	
Fruit Tree Leaf-roller	Carbaryl 80% S	1 to 1/4 lb
Note:	Apply in popcorn stage.	
	CHESTNUT	
Mites	Malathion 25% WP	2 lb
Note:	No pesticides are registered to control weevils, Japanese beetles, and other insect pests of chestnut.	

Pest	Material	Dosage (per 100 gallons)
	FILBERT	
Aphids	Carbaryl 80% S	1 to 1/4 lb
	Diazinon 50% WP	2 to 4 lb
	Diazinon AG 500	1 to 2 qt
	Malathion 57% EL	1 pt
	Malathion 25% WP	2 lb
Filbertworm	Carbaryl 80% S	1 to 1/4 lb
	Note: Spray when moths are seen.	
Leafroller	Carbaryl 80% S	1 to 1/4 lb
	Diazinon 50% WP	2 to 4 lb
	Diazinon AG 500	1 to 2 qt
	Note: Apply when eggs are hatching.	
Scale Insects	Malathion 57% EL	1 pt
	Malathion 25% WP	2 lb
	Note: Apply on crawlers.	
	PECAN	
Casebearer	Diazinon 50% WP	2 to 6 lb per acre
	Diazinon AG 500	1 to 3 qt per acre
	Malathion 25% WP	3 lb per/acre
	Note: Do not apply after husks crack. 21 days of harvest.	
Mites	Diazinon 50% WP	2 to 6 lb per acre
	Dimethoate 2.67 E	1 pt per acre
	Malathion 57% EL	1 to 2 pt per acre
	Malathion 25% WP	2 to 3 lb per acre
	Note: Do not apply after husks crack. 21 days of harvest.	
Walnut Caterpillar	Diazinon 50% WP	2 to 6 lb per acre
	Note: Do not apply after husks crack. 21 days of harvest.	
	WALNUT	
Aphids	Diazinon 50% WP	2 lb per acre
	Diazinon AG 500	1 qt per acre
	Malathion 25% WP	1/2 to 1 lb per 100 gal
	Note: Do not apply after husks open.	

Pest	Material	Dosage (per 100 gallons)
Husk Fly	Malathion 25% WP	1 to 1 1/2 lb per 100 gal
	Note: Should be combined with Staley's sauce bait for best results. This attracts the adult flies; they feed on the bait and are killed before depositing eggs in the husks.	

Unfortunately, this bait is not readily available to the Pennsylvania nut growers, and we understand that the smallest lots for sale are in 55-gallon drums in truckload lots. This type of sale arrangement excludes its use by practically all Pennsylvania growers.

Over the years, other baits have been reported to be effective in attracting the adult flies to feed. In place of Staley's bait, the possible substitutes include skim milk, household ammonia, and brewer's yeast. Suggested rates for trial would be 1 to 2 pounds of either material per 100 gallons of spray.

Mites	Diazinon 50% WP	2 lb per acre
	Diazinon AG 500	1 qt per acre
	Malathion 25% WP	1/2 to 1 lb per gal
	Note: Should be combined with Staley's sauce bait for best results.	
Walnut Caterpillar	Diazinon 50% WP	6 lb per acre
	Diazinon AG 500	3 qt per acre
	Note: Should be combined with Staley's sauce bait for best results.	

Prepared by Stanley G. Gesell, Professor, Entomology Extension

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FIELD CROP INSECT PESTS

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llege of Agriculture, The Pennsylvania State University, University Park, Pennsylvania

PESTS OF ALFALFA

POTATO LEAFHOPPER

These small, pale-green sucking insects migrate into fields about mid-June. New seedings are often seriously injured, and second and third cuttings of established stands are frequently damaged. Leafhoppers are probably the most destructive insect pest of alfalfa. They are responsible for reduced yields of second and third cuttings of as much as 1/4 to 1/2 ton per acre. A loss of up to five percent of the protein content of alfalfa is not uncommon.

Symptoms (yellow, stunted plants) do not show up until it is too late to protect the crop. It is, therefore, important to keep a close check for infestations of this pest. Check new seedings regularly beginning in mid-June, and check second and third cuttings when the new growth is about four inches tall. With an insect net, make a sweep through the alfalfa at ten different places in the field. An average of one or more leafhoppers per sweep of the net indicates a population high enough to warrant control measures on established fields; five leafhoppers in ten sweeps should be the signal to treat new seedings.

When populations are high enough to warrant control, spray new seedings if there are two or more weeks to go before cutting. Second and third cuttings should be treated when the new growth is approximately four to six inches high.

ALFALFA WEEVIL

The larvae of the alfalfa weevil are very small, yellowish-green to light-green worms with black heads. They feed on the leaflets of the growing tips from late April to early June. Light to moderate feeding causes a silvery cast at the tops of the plants. Large populations of larvae often cause severe defoliation.

Overwintering is either as eggs in alfalfa stems or as adult weevils. Most eggs are deposited during April and May. Damage is usually confined to the first cutting and to new growth of the second cutting.

On fields that are near harvest and show injury, harvest as soon as possible. If the field shows damage several weeks before harvest, delay the spray application until 75 percent of the plant tips show slight feeding injury. Stubble may need spraying if larvae and adults are numerous enough to hold back the new growth.

ALFALFA LEAF BLOTCH MINER

The adult stage of the insect is a dull-black, humpbacked fly less than one-fourth the size of a housefly. The insects pass the winter as small, dark-brown, capsule-like pupae in rubbish on the ground. Adult flies emerge in May and make pinhole punctures in the alfalfa leaflets as they feed and deposit eggs. It is not unusual to see 50 or more such pinholes in a leaflet. Eggs are deposited between the upper and lower surfaces within leaflets.

The tiny, cream-colored maggots eat the tissue between the leaf surfaces, but do not eat through to the surface. The mines are narrow at first and gradually broaden out into an irregular-shaped blotch. Several blotches may be found on the same leaflet. This injury looks worse than it is; to date, the actual reduction in total digestable nutrient (TDN) from this pest has not been substantiated. An infestation must have more than 50 blotches per stem before any economic loss can be measured.

Each year there are three generations and possibly a partial fourth. Adult fly populations are lowest during the first week of June and reach fairly high peaks in mid-July and again in mid-August.

Damage solely from the leaf blotch miner is not likely to be a serious problem. However, when the miner and alfalfa weevil are working on the same field, damage can be severe.

Harvesting at the proper time will likely keep the leaf blotch miner in check.

SPITTLEBUG

Small grain stubble is a favored site for fall egg laying, so the greatest spittlebug populations will usually be in new seedings where oats were used as a companion crop. Injury is done by the nymphs and only to the first cuttings. An average of 3/4 to one nymph per stem can reduce the yield enough to warrant control measures.

The small, greenish, slimy nymphs start hatching in late April; their presence on plants is noted by the small, white mass of spittle surrounding them. Nymphs suck sap from the plants and use it for food and to produce spittle for protection. Typical spittlebug damage is stunted plants with small and crinkled leaflets.

Adult spittlebugs appear usually in mid-June and are present through the summer. They are weathered brown, hard shelled, and about the size and shape of a grain of wheat. The adults do not damage field crops.

PEA APHID

Green pea aphids can be found in every alfalfa field in the state from April to October, but are seldom abundant enough to cause serious damage. The greatest populations have appeared in the eastern half of the state during April and May, and in some years, threatening populations have built up during August. The aphid population is usually kept in check by a fungus disease and by parasites and predators.

Pea aphids are sucking insects 1/8 inch in diameter. They normally feed in colonies near the tops of the plants. Heavily infested plants will be shiny from the honeydew secreted and dropped to the leaflets below.

Chemical control is not suggested unless the aphids exceed 30 per sweep of an insect net with more than 10 days until harvest.

EUROPEAN ALFALFA BEETLE

This is a potential pest of alfalfa. In Pennsylvania, it has not yet been found feeding on alfalfa, but it has attacked the weed, bouncing bet. It is, however, a pest of alfalfa in Europe, where it originated.

This beetle and its larvae look like half-grown Mexican bean beetles; the number of black spots on the back varies. Like the Mexican bean beetle, the European alfalfa beetle also belongs to the lady beetle family, but feeds on plants instead of insects.

PESTS OF CORN

SEED CORN MAGGOT

Seed and root maggots are always present, but cool, moist conditions are most favorable to their development. Some damage is expected every year. The maggots work and feed on the sprouting seed; the result is either a weakened plant or one that dies before it gets out of the ground.

The gray adult flies are similar to houseflies in general appearance, but are smaller. They are most active in April and May, but are present throughout the season; there are three or more generations per year.

It is the first generation maggot about which corn producers are concerned. Average reduction of stored plant from this pest is in the five- to ten-percent range, but in some fields, the number of seedlings destroyed may be as high as 75 to 90 percent.

Any planting scheme that will hasten germination and growing will help reduce maggot injury. As no-tillage can be expected to slow germination, more maggot damage can be expected in no-till fields than in conventional fields.

Although corn varieties exhibit a wide range of tolerance to bacterial wilt, most varieties adapted to Pennsylvania do not break down completely when infected with the disease. Yields will be reduced.

EUROPEAN CORN BORER

It is difficult to justify the cost of treatment for corn borers on field corn. None of the approved insecticides is good enough to do an acceptable job with one or even two applications, and losses average only two to three percent.

Other than using tolerant hybrids, no special controls are suggested for borers in field corn except under very heavy infestations. If more than 75 percent of the plants show moderately heavy feeding on the whorl in late June, chemical treatment should be used.

The riddled leaves in the whorl of plants in late June always appear much worse than are the actual losses. Larvae that enter the stalks may cause some stalks to break over and some shanks to break away from the stalk, but this seldom reaches serious levels.

Corn borers have two generations per year; moths emerge in June and again in late July and early August. The first generation larvae (borers) that appear in June are responsible for more damage to corn than are those of the second generation.

GARDEN SYMPHYLAN

Damage from garden symphylans appears to be more widespread each year. Although they are distributed throughout the state, the largest areas of infestation are scattered through the eastern half of the state.

The small, white, centipede-like animals live in the soil and are about 1/3 inch long when fully grown. They attack the roots of several plants, but corn is one of their favorite hosts. They cut off the hair roots and often chew into larger roots and tubers. Only brown stubs remain where feeder roots should be. Fields are seldom uniformly infested; symphylans are usually concentrated in irregular-shaped areas of less than an acre. All crops in the infested areas are badly stunted.

The first symptoms of garden centipede or symphylan damage are poorly growing plants in small irregular areas in the field. Suspected plants should be dug up with a shovel, and the soil around the roots should be sifted to see if any symphylans are present.

STALK BORER

In late fall, the adult moths deposit their eggs on grasses and dried leaves of corn plants. The newly hatched larvae enter the nearest suitable host in May. Usually, grasses are the first plants attacked, but the borers soon move to young corn plants. The borers may enter the corn stalks at the base and work their way up through the stalk or climb up the stalk to feed on the rolled leaves at the top. Corn plants are usually attacked when they are between two inches and two feet high.

The larvae have a dark-brown head and a purplish body with white stripes. A purple-brown band circles the middle.

PESTS OF OATS

CEREAL LEAF BEETLE

Although this insect will feed on a variety of plants in the grass family, oats have been the only crop severely damaged in Pennsylvania. Both the adult beetles and the larvae feed on the oat leaves, but most of the damage is caused by the slug-like larvae. The larvae start feeding about mid-May, and by late May, typical damage is readily noticed. The larvae eat away elongated stripes of the upper leaf surface parallel to the veins. Such injury results in a white, frosted appearance to the tops of the plants. Damaged leaf areas eventually turn a rusty brown color.

The larvae are 1/16 to 1/4 inch long, humpbacked, greenish-yellow, slimy, and slug-like. Most of them will appear black because they cover themselves with a glob of slimy, black fecal matter.

Research has shown that an average of one larvae per stem of oats will reduce the yield about three bushels per acre. Approximately five larvae per stem are required for complete defoliation. Young larvae have a fairly high normal mortality rate, so it is not profitable to spray oat fields to control cereal leaf beetles unless the larval population averages more than one per stem.

PESTS OF SOYBEANS

SEED MAGGOTS

Several species of root maggots attack the germinating beans in the soil. (Refer to the "Corn" information for more about this pest.) Damaged seeds or seedlings fail to produce a healthy plant. The reduction in stand from attack by maggots may be as high as 75 percent, but is commonly 10 to 15 percent. Since some damage occurs in every field each year, all seed should be treated with an insecticide before planting.

The same planter-box seed treater used for corn may be used for soybeans. Follow label directions for dosage.

GREEN CLOVERWORM

This slender, light-green caterpillar with faint white stripes caused moderate defoliation on soybeans throughout Pennsylvania in 1973. The worms are about an inch long when fully grown, and they loop when they move. Their feeding in the plant leaves a ragged appearance. Damage usually begins to appear in late July, and the injury peak is in early August.

The green cloverworm is present each year; it feeds on a wide variety of plants but is seldom a destructive pest. A fungus disease has been effective in reducing the number of larvae.

The insect passes the winter either as a pupa or adult moth. The moths are dark brown with lighter markings on their wings. The wingspread is approximately 1 1/4 inches. At least two generations are produced per year. The second generation of worms causes the most defoliation to soybeans.

Bean plants can withstand some defoliation; six to ten worms per foot of row should be present before control measures are used.

JAPANESE BEETLE

This coppery green beetle is abundant during July and August and will feed on a variety of plants. Their feeding on the leaves of soybeans causes a typical skeleton pattern. They eat the upper portion of leaves between the veins. The skeletonized portion of the leaf soon turns brown.

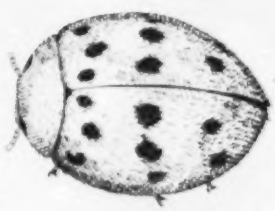
The larvae are white grubs resembling June beetle grubs. They are white, plump larvae and are always in a C-shaped curve. They have six legs and are about 3/4 inch long when full grown. The grubs feed on grass roots and are very destructive to lawns and other turf areas. There is only one generation per year.

Practically every soybean field in the state will have some leaf damage by Japanese beetles, but the extent of the feeding is usually so minor that the yield is seldom affected. Soybean plants can tolerate up to 20 percent defoliation without any appreciable economic loss.

Control measures for Japanese beetles on soybeans may become necessary if more than 25 percent of the plants are defoliated.

MEXICAN BEAN BEETLE

These small, yellow to bronze beetles with black spots are the same as those that feed on the leaves of garden beans. Mexican bean beetle larvae do more damage than do the adults. The larvae are bright yellow covered with many branched spines. They skeletonize the undersides of leaves. The eggs are also bright yellow and are easily seen in tight clusters on the undersides of leaves.



Mexican bean beetles have not been a serious pest of soybeans, although a few can be found in almost every field.

THRIPS

These tiny (about 1/16 inch) cream-colored rasping insects are sometimes abundant enough to cause damage to the foliage and tender stems. The insects scrape the surface of the leaf or stem and feed on sap that comes from the ruptured cells. Such damage first shows up as white stippling that soon turns to copper or brown. Heavily damaged leaves and stems cannot function properly, and bean yields are reduced.

Infestations are seldom of any great importance, and control measures are needed only occasionally.

PESTS OF WHEAT

HESSIAN FLY

The tiny, fragile, black flies are seldom noticed even when they are active in the field in April and September. The pupal stage is most easily found on the wheat stem. The Hessian fly damage is the lodging or breaking-over of wheat stems a short time before harvest. In the bent or broken area of the stem, dark-brown fly puparium can be found. These pupae are called flaxseeds because of their close resemblance in size, shape, and color to true flaxseed.

Plants that lodge before harvest produce heads that are small, contain chaffy grain, and are often poorly filled.

There are two generations of Hessian fly per year. However, if moisture is abundant in July and August, a supplementary generation may be produced. Flies are active and lay eggs in late August and in September. Maggots develop on newly emerging wheat plants in the fall and change to pupae by November to pass the winter. The spring brood of flies active in April gives rise to the maggots that weaken the stems.

For many years, the only effective control of this pest was to plant wheat after the "fly-free" date in late September or early October to avoid the fall generation of flies. Many good, adapted, resistant varieties are now available.

Prepared by Stanley G. Gesell, Professor, Entomology Extension

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INSECT PESTS OF VEGETABLE CROPS

All vegetable crops are subject to insect problems, but the amount of damage done by insects is variable from season to season and from one area to the next. About 12 insect species are present in great enough numbers each year to inflict significant crop losses in most areas of Pennsylvania. These insect pests of major economic importance will be discussed here.

The purpose of this publication is to assist you in identifying specific insects and recognizing damage to vegetable crops inflicted by the pests. Chemical control measures are not included. Insecticide registrations are frequently changed; therefore, chemical control suggestions for vegetable insect pests are made available in the current issue of the commercial vegetable pest control guide.

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PESTS OF ASPARAGUS

ASPARAGUS BEETLE

Two species of small beetles damage asparagus spears. They both cause similar damage, their life cycles are similar, and control measures are the same for both species. The adult asparagus beetle is about 1/4 inch in length and is bluish-black with yellowish-red patches on its back. The spotted asparagus beetle is yellowish-orange with 12 black spots. One or both species may be present in a given patch.

The beetles start appearing when the first spears are ready to harvest. The black, elongate eggs are glued on end to the spears. This, combined with feeding by the adults and their small, slug-like larvae, ruin the spears for sale. At least two generations are present each year; the adult beetles of the summer generation often feed on the brush, causing severe defoliation and browning.

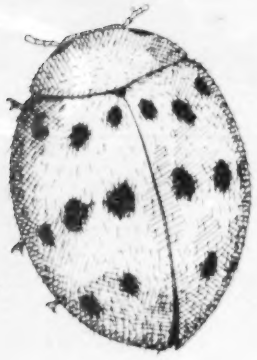
PESTS OF BEANS

BEAN APHID

These small (1/16 inch), black, soft-bodied, sucking insects feed in colonies near the plant tips and on the flower buds of lima beans. Their feeding results in distorted plants, and many of the blossoms fail to develop pods. Aphids can be present from early summer to fall because many generations are produced each year.

Snap beans are seldom damaged by aphids.

MEXICAN BEAN BEETLE



These small (1/4 inch), terrapin-shaped, bronze beetles with black spots attack all types of beans, but are mainly a problem on snap beans. The eggs are bright yellow, and are deposited on end in clusters on the undersides of the leaves. The larvae are yellow and are covered with branched spines.

Most damage is done by the larvae eating away the undersurface of leaves, causing skeletonized foliage. They will also eat holes into the green pods. They overwinter as adult beetles. At least two generations are produced each year.

SEED CORN MAGGOT

Small, dirty-white maggots feed on the seed, roots, and stems of young seedlings. Bean plants may poke through the soil as "snake heads" but fail to continue normal growth.

Dark-gray adult flies are active after a few warm days in the spring. The flies are similar in appearance to--but smaller than--horse flies. There are three or four generations per year.

Seed corn maggots are most serious in cool, wet soils high in organic matter. Any cultural practice that can hasten germination and plant emergence are the best methods to prevent seed maggot damage. Avoid deep planting in cold soils. A commercial seed treatment will help prevent damage to the beans. Proper use and dosage is explained on label directions.

EUROPEAN CORN BORER

This is probably the most destructive insect pest of snap beans being grown for processing. Larvae of the second generation corn borer start hatching in early August and enter the pods. This can cause a high percentage of beans to be rejected by the processor. (See "Pests of Corn" for a description and sketch of this pest.)

PESTS OF COLE CROPS

ROOT MAGGOT

Small (1/8 inch), dirty-white maggots feed on the stem portion of the plants below ground level. This feeding often causes complete girdling of the stem. Affected plants suddenly wilt and often die. When soil moisture is adequate, auxiliary roots may develop above the injured area, permitting the plant to survive.

The dark-gray adult flies are active in April. There are three or four generations per year.

Although plant mortality and injury caused by this pest varies from one year to the next, the root maggot is constantly one of the most troublesome insect pests in both the plant bed and in the field. Many of the insecticides and methods of application used for a number of years are either ineffective or no longer registered for this use. The choice of approved insecticides and methods for application are extremely limited.

CABBAGE WORM

Light-green, soft, velvety worms as long as one inch eat irregular holes in leaves. Large numbers of worms may completely riddle the leaves. Their dark droppings lodge in the axils of leaves, increasing the unattractiveness of the product.

The winter is passed in the pupal stage, and the white adult butterflies can be seen in the field from May until fall. There are at least two generations per year.

CABBAGE LOOPER

The larvae, or loopers, are light green with pale white stripes. They can easily be distinguished from cabbage worms by their looping movement.

Their life cycle is similar to that of the cabbage worm, except the adults are brown moths. Feeding damage of the two species is essentially the same. Pennsylvania always seems to have a fairly high population of imported cabbage worms, but for the past several seasons has had low populations of cabbage loopers. The imported cabbage worms get an early start and can cause moderately severe injury by mid-season. The looper problem is most severe in early fall. Fortunately, the imported cabbage worm is more easily controlled than the cabbage looper.

PESTS OF CARROTS

LEAFHOPPER

Several species of leafhopper attack carrots. The six-spotted leafhopper is the principal carrier of aster yellows, a virus disease of carrots. Leafhopper control is essential for this area if quality carrots are expected.

Leafhoppers are very small (less than 1/8 inch) and pale green. The adults fly readily when disturbed; the nymphs commonly move sideways when they walk on the leaves. Most damage is done from June to August.

Typical symptoms of leafhopper damage are stunted, yellow tops. The roots are often covered with fine, fibrous root hairs.

PESTS OF CUCUMBER, MELON, AND SQUASH

STRIPED CUCUMBER BEETLE

During years when striped cucumber beetle populations are high and the incidence of bacterial (cucurbit) wilt is also high, the potential trouble for the next season can be serious. Bacteria overwinter in the gut of the beetle; when beetles feed on new plants the following summer, they transmit the disease. It is practically impossible to grow cucumbers and cantaloupes without some kind of protection from the beetles. Summer

squash and watermelons exhibit some tolerance to bacterial wilt.

Striped cucumber beetles are small (1/5 inch), yellowish-green, and have longitudinal black stripes. They overwinter as adult beetles and appear in the fields when young seedlings emerge or soon after potted plants are placed in the field. The beetles can riddle small plants and actually kill them if enough beetles are present. The greatest loss, however, is from the wilt disease, which may not affect the plant until weeks after the initial infection has taken place.

PESTS OF EGGPLANT

FLEA BEETLE

These little black beetles eat tiny round holes in the leaves. Flea beetles are present from the time plants are put into the field until late summer. The greatest damage from flea beetles is usually to transplants shortly after they are placed in the field. Depending on the flea beetle population, transplants may need protection until they become established. A second generation feeds on the leaves in late July and August. Vigorous-growing plants can usually outgrow this feeding without additional spray protection.

COLORADO POTATO BEETLE

This insect is steadily increasing in importance as a pest of eggplant. Most damage is done by the soft, humpbacked, dark-red larvae. They eat the leaves, causing partial to complete defoliation. Although they are primarily pests of potatoes, they will attack eggplant, pepper, and tomatoes.

Overwintering adult beetles are 3/8 inch long, stout, and convex. They are black with narrow pale-yellow stripes along the back. (See "Pests of Potatoes" for a sketch of this insect.)

PESTS OF PEAS

PEA APHID

This large (3/16 inch), green aphid is a sucking insect, and when abundant, will cause a reduction in yield.

A few aphids can be found in every pea field in the state--but not every field has an aphid problem. This means that in most fields the aphid population is well below the economic damage level. This aphid is quite susceptible to a fungus disease which normally keeps the population in check. When damage from pea aphids occurs, it is usually in the southern portion of Pennsylvania. Some processors may require a low number of aphids on plants, but a typical field of peas can tolerate as many as 40 aphids per sweep on an insect net before control measures are warranted.

PESTS OF PEPPER

EUROPEAN CORN BORER

This is the most destructive insect pest of peppers in the state. The damage is done during August and September by second-generation larvae that enter the fruits. In light infestations, the borer usually enters the fruits on the stem end, but in moderate to heavy infestations, entry holes chewed into the sides of fruits are very common. Pepper growers have experienced enough damage over the past few years from corn borers that a preventive control program is suggested.

Corn borer larvae eating inside the fruits of pepper are pinkish-white worms up to 3/4 inch in length. Their bodies are covered with many dark-brown spots. Corn borer larvae are active when exposed to sunlight.

GREEN PEACH APHID

This small (1/16 inch), soft, yellowish-green aphid is a sucking insect that feeds in small colonies on the undersides of leaves and on growing tips. It feeds on a variety of vegetable crops, and can be considered one of the major insect pests that the vegetable grower has to fight.

When large numbers of this aphid are present, the plants have a shiny appearance from the honeydew secreted by the aphids. Plants carrying a large population of aphids will be stunted, and production will decrease.

PESTS OF POTATOES

COLORADO POTATO BEETLE

This is the same insect pest that our grandparents called the potato bug. After approximately 25 years of low populations and minor damage, it is now increasing in numbers. Most of the damage is done by the soft, hump-backed, dark-red larvae. Partial to complete defoliation occurs as they eat the leaves.

Colorado Potato Beetle

The winter is passed in the soil as adult beetles. The stout, convex beetles are about 3/8 inch long with a pale-yellow body and 10 black, narrow stripes running lengthwise on the back. They emerge in May and soon deposit bright yellow-orange clusters of eggs on the undersides of the leaves. Most damage is done by larvae of the first generation which are present from May well into July.

FLEA BEETLE

These tiny, hard-shelled, black beetles eat small round holes in the leaves. They jump when disturbed. Overwintering is as adult beetles in the soil; they emerge soon after potato plants come through the soil. There are two generations per year with population peaks in May and early June, and again in mid-July. Spraying systemic soil insecticides at planting time usually keeps flea beetles in check and also controls the Colorado potato beetle.

GARDEN SYMPHYLAN

The description of this pest can be found with insects that attack corn.

PEACH APHID

Very small (1/16 inch), yellowish-green aphids move into potato fields in early July. They can usually be found in small colonies on the undersides of lower leaves. As populations increase, the middle and upper leaves become infested. When infestations are severe, the plants have a shiny appearance from the honeydew that covers the leaves. Heavily infested plants also appear wilted.

This pest is one of the most destructive insects to the potato crop. It not only greatly reduces the yield but is also responsible for the transmission of several virus diseases of potatoes.

POTATO LEAFHOPPER

The description of this insect was given with pests of alfalfa. Its damage to potato leaves is seen as brown leaf margins and cupped leaves. This damage is referred to as "hopper burn" on potatoes.

PESTS OF SPINACH

GREEN PEACH APHID

See the discussion under "Pests of Pepper."

SPINACH LEAFMINER

This small fly maggot destroys the tissue between the upper and lower leaf surfaces. The damaged areas turn from green to white to brown. Infested leaves are unfit for food. It is not uncommon to see plantings with 25 to 50 percent of the leaves ruined by this insect. Harvesting such a crop is not profitable.

The winter is passed in the pupal stage, and the small, gray, adult flies emerge in early May and deposit their eggs in the leaves of spinach, beets, or Swiss chard. Three or more generations occur per year.

PESTS OF SWEET CORN

SEED CORN MAGGOT

This is the same insect as described in the "Pests of Beans" section.

CORN FLEA BEETLE

These tiny, black, hard-shelled, jumping beetles have increased in importance during the past several years. They are carriers of Stewart's disease, or bacterial wilt, of corn. The bacteria overwinter in the gut of the beetles, and the beetles transmit the disease to the young corn plants in the spring. Flea beetles emerge in early to mid-May and begin to feed on corn when it is still in the spike stage. Winter temperatures play an important role in the abundance of corn flea beetles the following spring. It is now evident that mild winters permit survival of a large population of overwintering flea beetles. If the total of the average temperatures for the months of December, January, and February is 90° F. or more, winter survival is expected to be high. Many areas of Pennsylvania have had winter temperatures above normal for the past several years.

If conditions appear favorable for flea beetles, it will be beneficial to select varieties that are resistant or tolerant to bacterial wilt.

CORN EARWORM

These are large (up to 1 3/4 inch), plump, pinkish-brown worms that feed on kernels at the tip of the ear. The moderately large buff-brown moths deposit their eggs on fresh silks. Infested ears are usually rejected by sweet corn buyers (mainly because of appearance). It is practically impossible to detect infested ears until the protective husks are pulled back to expose the kernels.

Corn earworm infestations are usually low in corn that is harvested early. Earworm damage is usually most severe in sweet corn that reaches the silk stage after August 15.

Winter mortality of the earworm is high in Pennsylvania, and early summer infestations are dependent primarily on moths that migrate into the state during June and July. These numbers are usually low, so the first-generation worms are seldom abundant enough to be of major importance; the second-generation worms are often extremely destructive.

EUROPEAN CORN BORER

The larvae, or borers, are flesh colored and marked with brown spots. Fully grown worms are approximately 3/4 inch long. The first evidence of corn borer infestation shows up during the latter part of June. Pinholes can be found in the leaves, and the whorl and developing tassel are destroyed. The larvae will later bore into any part of the stalk and into the ears.

The greatest amount of damage to sweet corn by the corn borer is done by the first generation. Corn is normally past the highly attractive stage of development when the second generation moths are active in late July and early August. (This generation of corn borer is destructive to peppers, beans, and other vegetables.)

Corn borers pass the winter as fully grown borers inside their host plant. They pupate in May and June; the first generation moths are active during June. The moths are buff colored with a wing expanse of about one inch.

GARDEN SYMPHYLAN

Damage from garden symphylans appears to be more widespread each year. Although they are distributed throughout the state, the largest areas of infestation are scattered through the eastern half of the state.

The small, white, centipede-like animals live in the soil and are about 1/3 inch long when fully grown. They attack the roots of several plants, but corn is one of their favorite hosts. They cut off the hair roots and often chew into larger roots and tubers. Only brown stubs remain where feeder roots should be. Fields are seldom uniformly infested; symphylans are usually concentrated in irregular-shaped areas of less than an acre. All crops in the infested areas are badly stunted.

The first symptoms of garden centipede or symphylan damage are poorly growing plants in small irregular areas in the field. Suspected plants should be dug up with a shovel, and the soil around the roots should be sifted to see if any symphylans are present.

PESTS OF TOMATOES

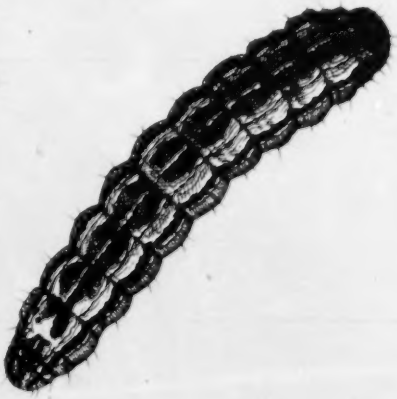
APHIDS

From about mid-June through the growing season, these small (1/8 inch), pink and green, soft-bodied, sucking insects are often present on stems near the growing tips. This species is not often a serious problem. Natural controls usually keep aphid numbers down to a level of minor importance; chemical control measures are seldom needed.

A very small (1/16 inch), yellowish-green aphid, the peach aphid, may move into fields about mid-July. This species can build up populations rapidly and can cause serious damage to plants.

CUTWORM

Several species of these large (1 to 1 1/2 inch), gray to black, fleshy worms live in the soil and cut off plants near the ground level. Cutworms are usually most numerous in fields that were in sod or small grain the previous year.



Cutworms are the larvae of moderately large moths. The moths deposit their eggs in early fall in weedy and grassy areas. Eggs hatch in the fall, and the cutworm larvae go through the winter partially grown in protected areas in the field. They complete their growth in the spring.

FLEA BEETLE

These are small (1/16 inch), black, hard-shelled, jumping beetles that eat many small holes in the leaves of the plants. Flea beetles cause greatest damage to newly set transplants. The shock from transplanting plus the loss of additional foliage by the feeding of beetles can retard establishment of the plants. Flea beetles are of minor importance after plants are well established and growing.

COLORADO POTATO BEETLE

Although this insect is primarily a pest of potatoes, it has been a problem in a few fields of direct-seeded tomatoes. The damage by the soft, dark-red, humpbacked larvae is similar to that on potatoes. Larvae eat the leaves and defoliate the plants.

HORNWORM

A few hornworms are always present in a tomato field, but they are seldom abundant enough to warrant a spray application. Hornworms are large, plump, and green with a red or black curved "horn" protruding from the top of the rear of the worm. Fully grown worms are up to two inches long and have white diagonal marks along the sides.

They are first noticed when one or two branches are completely defoliated, and when dark, pellet-like droppings are found scattered on the ground below.

The adults are large hawk moths, often called humming-bird moths. They overwinter in the soil in the typical dark-brown, jug-handle pupal case.

WHITEFLY

Although we call this little insect whitefly, it is not related to the true flies, but is closely related to the scale insects. The adults are tiny (1/20 inch), white and fragile, have four wings, and readily fly up from the foliage when disturbed. The larvae are also extremely tiny, colorless, flat and immobile, and are difficult to detect on the undersides of leaves. They suck sap from the plants, and they secret honeydew; hence, their damage is similar to that of aphids. They are seldom noticed before mid- or late July.

This species does not survive the winter outdoors. Infestations come from infested plants brought into the area. Therefore, infestations can be prevented by carefully examining plants to be certain they are "clean" before going into the field.

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